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BRIERLEY ASSOCIATES
Creating Space Underground

CASE STUDY AEC

Project
ROAD TUNNEL INSPECTION

KEY ACHIEVEMENTS

Tunnel inspection time cut by 85%

Reduced safety risk for the survey team

Faster collection of detailed, high grade data to inform maintenance planning

Improved ability to detect structural changes over time

Minimum traffic disruption

BRIERLEY ASSOCIATES SPEEDS UP ROAD TUNNEL INSPECTION

OVERVIEW

Brierley Associates is a US engineering consultancy headquartered in Denver, Colorado. It specializes in the design, construction, and maintenance of tunnels and other underground infrastructure. The firm's experience spans the water, wastewater, transport, and mining sectors.

INSPECTING A ROAD TUNNEL SAFELY WITH MINIMAL DISRUPTION TO TRAFFIC

In mid-2020, Brierley Associates inspected a two-lane road tunnel in Colorado's front range region. Constructed in 1939 by cutting through the mountainside in a narrow roadway canyon, the tunnel measures 125.2 meters (410.8 feet) in length and 9.1 meters (29.9 feet) in width.

Regular inspection of road tunnels is necessary to identify cracks, movement, unstable rock masses, and deformities that could potentially compromise their structural integrity.

Historically, inspections of this tunnel were carried out manually by field personnel walking its length and taking notes and photographs. This exercise typically took at least six hours and had to be carried out in daylight. During this time, the tunnel would be closed to vehicle traffic for safety reasons.

Brierley Associates sought a solution that would allow its engineers to capture the data needed to complete an inspection thoroughly and safely in a short timeframe.

IN A ONE HOUR INSPECTION, BRIERLEY ASSOCIATES CAPTURED THIS SCAN OF THE TWO-LANE ROAD TUNNEL THAT THEY CAN USE TO DETECT AND PROVIDE REHABILITATION OPTIONS FOR ANY DEFORMITIES.

DELIVERABLES

Point cloud data captured by Hovermap was processed using Emesent software. The Brierley geotechnical engineering team subsequently completed a registration using CloudCompare. This analysis can be used as a baseline to identify tunnel movement when compared to future scans.
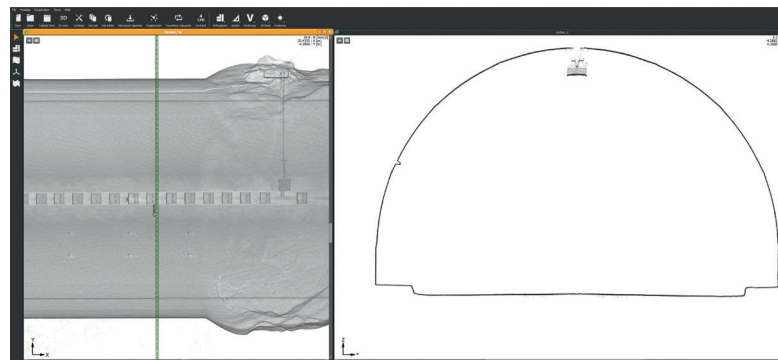
Brierley will also be able to use the data collected to provide stakeholders with a cross section of the existing tunnels, provide rehabilitation options for any deformities, and calculate shotcrete volumes within the tunnels. It can also be imported into AutoCAD Civil 3D to help build out digital twins. Brierley also plans to use the data to develop construction contracts.

DETAILED DATA CAPTURED IN 1 HOUR

Deploying Hovermap allowed Brierley Associates to inspect the tunnel within an hour and report on its condition the same day.

Hovermap's ability to operate in low light conditions meant scans could be carried out at night, with limited inconvenience to the public.

Having detailed point cloud data of the tunnel made it easier for Brierley personnel to identify potential issues and areas where failure may occur and to recommend early intervention to prevent disasters.

FASTER, SAFER INSPECTIONS WITH HOVERMAP LIDAR

In February 2020, Brierley Associates acquired a Hovermap LiDAR autonomy and mapping payload for its Geographic Information System Mapping team to use in a variety of settings.

The Hovermap mobile scanner was used by a Brierley Associates mapping specialist to capture data of the tunnel during a one-hour inspection conducted at night to minimize traffic disruption. Two walking scans were completed during this time.

> "Hovermap is a great solution because its versatility allows us to collect data in many different ways, including by flight and walking scans. Not only does this make it easier for us to capture the data we need, it means we're able to provide more services to our customers."
>
> **Shane Zentner, Brierley Associates Senior GIS Analyst/ Remote Sensing Specialist**

The Hovermap point cloud in .laz can be imported into 3D software to quickly and easily calculate measurements and volumes for the scan.

Project
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> "Hovermap makes tunnel inspection and subterranean mapping easy, and the highly detailed data it captures has a myriad of potential uses. These include helping us identify issues earlier and informing our remediation and rehabilitation recommendations."
>
> **Shane Zentner, Brierley Associates Senior GIS Analyst/ Remote Sensing Specialist**

Using Hovermap, Brierley Associates was able to scan the tunnel at night, reducing safety-required closures and the impact to traffic while still capturing highly detailed data that can be used to inform remediation and rehabilitation recommendations.

LOOKING AHEAD

The future of tunnel inspection

Manual inspections and photographs will soon become a thing of the past as organizations turn to digital tools and sophisticated analytics software to detect tunnel movement and gauge maintenance requirements.

The use of LiDAR scanning during the tunnel inspection process makes it possible to:

- obtain greater spatial coverage and accurate, highly detailed baseline data
- monitor change at thousands of points within a tunnel
- carry out assessments more frequently
- prevent disasters by detecting issues and potential points of failure faster

Brierley Associates plans to incorporate Hovermap LiDAR scanning into its service offering for other infrastructure clients. Hovermap's versatility makes it a compelling choice – the unit can be used for walking, vehicle- or backpack-mounted scans, lowered inside a cage into underground spaces, and drone-mounted to provide autonomous mapping in challenging, inaccessible areas.

The LiDAR scan provides Brierley Associates with highly detailed baseline data that will allow them to monitor thousands of points within the tunnel for change and detect issues and potential points of failure faster.

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Our flagship product Hovermap, is a smart mobile scanning unit that combines advanced collision avoidance and autonomous flight technologies to map hazardous and GPS-denied environments. Hovermap is uniquely versatile, it can be mounted to a drone, cage, backpack or vehicle to map challenging, inaccessible areas. With a wide range of applications, Hovermap is being used by customers around the world.

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